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Permanent GNSS stations, valuable source of information for geosciences

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Nowadays, permanent GNSS stations are widely used for (i) computation and dissemination of the differential GNSS corrections, i.e. DGPS service, and (ii) monitoring tectonic plate movements. Further to the mentioned main applications, continuity of the observations could make it possible to derive other additional products (by-products) from the observations of the permanent GNSS stations, which in some cases could be even more valuable than the main product of the stations. In this paper we are going to present a list of those products and would provide the related theoretical details. Besides, the required changes to the rates of GNSS observations and needed peripheral sensors that must be added to the permanent GNSS stations in order to make them suitable for other applications are presented. The list of considered applications, besides the aforementioned two, are: (i) local torpospheric modeling (ii) computation of the precipitable water vapor (PWV) of the atmosphere (iii) ionospheric modeling (iv) improvement of the orbital parameters of the GNSS satellites (v) study of the direct and indirect tidal effects on the Earth's crust. Our experiments with all the mentioned applications are presented in the paper.